

**BEST AVAILABLE COPY**

Serial No. 10/771,047 ..... Page 2

**RECEIVED  
CENTRAL FAX CENTER****FEB 07 2007**IN THE CLAIMS:

1. (Currently Amended) A robust scalable laser system comprising:  
plural fiber laser resonators;  
a high-power laser pump source coupled to each of said fiber laser resonators; and  
a spatial filter external to said laser resonators, said spatial filter adapted to  
combine plural laser beams output from said plural laser resonators into a single output  
laser beam, said spatial filter further including beam flattening optics.

2. (Original) The laser system of Claim 1 wherein said plural laser resonators are  
eye-safe fiber laser resonators.

3. (Original) The laser system of Claim 2 wherein said eye-safe fiber laser  
resonators include double-clad Er:YAG laser resonators.

4. (Canceled)

5. (Previously Presented) The laser system of Claim 1 wherein each of said high-  
power laser pump sources include a laser diode.

6. (Previously Presented) The laser system of Claim 1 wherein said pump sources  
are end-coupled via pigtails or discrete imaging optics.

7. (Previously Presented) The laser system of Claim 1 wherein said pump sources  
are side coupled, edge coupled, fusion coupled, and/or coupled via a reflective cavity.

Serial No. 10/771,047 ..... Page 3

8. (Currently Amended) The laser system of Claim 1 wherein said fiber laser resonators ~~are approximately equivalent lengths or~~ differ in length by more than 1.4 centimeters.

9. (Currently Amended) The laser system of Claim 8 further including ~~beam-flattening optics~~, a lens pair having a filtering aperture therebetween, and a feedback mirror to facilitate coherent combining and phase locking of said plural laser beams.

10. (Withdrawn)

11. (Withdrawn)

12. (Original) The laser system of Claim 8 wherein said cavity incorporates a light pipe.

13. (Currently Amended) An eye-safe laser system comprising:  
plural fiber laser resonators adapted to lase at eye-safe wavelengths;  
a high-power laser pump source coupled to each of said fiber laser resonators;  
and  
a spatial filter for combining beams output from said plural fiber laser resonators into a single eye-safe laser beam, said spatial filter including beam flattening optics.

14. (Currently Amended) The laser system of Claim 13 wherein said spatial filter ~~for combining~~ includes an external cavity.

15. (Original) The laser system of Claim 14 wherein said plural fiber laser resonators are coupled to plural pump sources.

16. (Original) The laser system of Claim 15 wherein said fiber laser resonators include integrated reflectors.

Serial No. 10/771,047 ..... Page 4

17. (Original) The laser system of Claim 16 wherein said integrated reflectors include distributed Bragg reflectors.

18. (Canceled)

19. (Currently Amended) The laser system of Claim 15 wherein said ~~spatial filter~~ includes beam-flattening optics are disposed adjacent to a pair of collimating lenses, said pair of collimating lenses having a miniature aperture therebetween and positioned adjacent to a partially transmissive feedback mirror.

20. (Original) The laser system of Claim 19 wherein said beam-flattening optics are characterized by hexagonal geometry.

21. (Original) The laser system of Claim 20 wherein said plural pump sources include diodes.

22. (Original) The laser system of Claim 21 wherein said fiber laser resonators are Er:YAG fiber laser resonators.

23. (Original) The laser system of Claim 22 wherein said laser resonators include resonator cores that are sufficiently different in length to facilitate longitudinal mode overlap among beams traveling along different resonator cores.

24. (Original) The laser system of Claim 21 wherein said plural pump sources include a diode emitter array for each of said plural fiber laser resonators.

25. (Original) The laser system of Claim 24 further including a light pipe adapted to couple beams output from said diode emitter array for each of said plural fiber laser resonators.

Serial No. 10/771,047 ..... Page 5

26. (Original) The laser system of Claim 24 further including a clad end-pumping configuration for coupling each diode emitter array to a corresponding fiber laser resonator.

27. (Original) The laser system of Claim 26 wherein said clad end-pumping configuration includes discrete imaging optics for imaging beams output from each diode emitter array into each fiber laser resonator.

28. (Original) The laser system of Claim 24 wherein said diode emitter array is adapted to transmit at wavelengths of approximately 1.5 microns.

29. (Currently Amended) A beam phase-locking system comprising:

first means for receiving plural single-mode beams of electromagnetic energy and providing flat-top beams as output in response thereto and

second means for combining said flat-top beams via spatial filtering and providing a collimated combined beam in response thereto, said first means including plural multiple fiber laser oscillators having integrated Bragg grating mirrors, said integrated Bragg grating mirrors representing a first end of a spatial filter included in said second means and said spatial filter including beam flattening optics, a collimating lens pair having a first collimating lens and a second collimating lens and an aperture therebetween.

30. (Canceled)

31. (Previously Presented) The system of Claim 29 wherein said fiber laser oscillators include Er-doped YAG crystal (Er:YAG) resonator cores.

32. (Original) The system of Claim 31 wherein said fiber laser oscillators further include dielectric cladding at least partially surrounding said resonator cores.

Serial No. 10/771,047 ..... Page 6

33. (Original) The system of Claim 32 wherein said resonator cores are approximately equivalent lengths.

34. (Previously Presented) The system of Claim 32 wherein said resonator cores are sufficiently different in length to facilitate longitudinal mode overlap among beams traveling along different resonator cores.

35. (Original) The system of Claim 34 wherein said resonator cores differ in length by more than 1.5 centimeters.

36. (Original) The system of Claim 31 wherein said Er:YAG resonator cores include YAG crystal doped with less than 0.5% Er molecular concentration.

37. (Original) The system of Claim 31 further including means for pumping said fiber laser oscillators.

38. (Original) The system of Claim 37 wherein said means for pumping includes plural diode emitters.

39. (Original) The system of Claim 38 wherein said means for pumping includes one or more pigtail couplers for coupling one or more diode emitters into each fiber laser oscillator.

40. (Original) The system of Claim 37 wherein said means for pumping includes discrete imaging optics for coupling one or more diode emitters into each fiber laser oscillator.

41. (Canceled)

Serial No. 10/771,047 ..... Page 7

42. (Previously Presented) The system of Claim 29 wherein said aperture, said first collimating lens, and said second collimating lens are positioned so that a focal point of said first collimating lens and a focal point of said second collimating lens approximately coincide at said aperture.

43. (Original) The system of Claim 42 wherein said spatial filter includes a feedback mirror positioned adjacent to one of said collimating lenses and at a second end of said spatial filter, said feedback mirror partially transmissive.

44. (Original) The system of Claim 43 wherein said first means includes beam-flattening optics positioned in front of said Bragg grating mirrors and before said first collimating lens.

45. (Original) The system of Claim 44 wherein said beam-flattening optics are characterized by hexagonal geometry.

46. (Currently Amended) An eye-safe laser system comprising:  
plural Er:YAG fiber laser resonators;  
plural high power laser pump sources coupled to said plural Er:YAG fiber laser resonators to pump said plural Er:YAG fiber laser resonators; and  
a spatial filter coupled to said plural Er:YAG fiber laser resonators and adapted to phase lock outputs of said fiber laser resonators to produce a single collimated combined laser beam as output in response thereto, said spatial filter further including means for providing a flat-top beam.

47. (Currently Amended) The laser system of Claim 43 ~~46~~ wherein said ~~phase locker~~ spatial filter includes first means for receiving plural single-mode beams of electromagnetic energy output from said plural Er:YAG fiber laser resonators and providing said flat-top beams as output in response thereto and second means for

Serial No. 10/771,047 ..... Page 8

combining said flat-top beams via spatial filtering to provide said collimated combined laser beam in response thereto.

48. (Currently Amended) The laser system of Claim 47 wherein said plural Er:YAG fiber laser resonators ~~are approximately equivalent lengths or~~ differ in length by more than 1.5 centimeters.

49. (Original) The laser system of Claim 48 wherein said first means includes beam-combining optics characterized by hexagonal geometry.

50. (Original) The laser system of Claim 49 wherein said spatial filter includes means for rejecting higher order beam modes arising from combining said flat top beams.

51. (Original) The laser system of Claim 50 wherein said spatial filter further includes means for reflecting a first portion of collimated energy back through an aperture between two collimating lenses and transmitting a second portion of collimated energy as output of said system.

52. (Currently Amended) An efficient multicore fiber laser comprising:  
plural high power laser pump sources that provide input electromagnetic energy;  
laser resonator cores coupled to said plural pump sources and arranged to receive said input electromagnetic energy and provide laser energy in response thereto, said laser energy travelling within said laser resonator cores; and  
a spatial filter coupled to outputs of said laser resonator cores, said spatial filter combining plural beams output from said plural resonator cores into a single coherent output flat-top beam.

53. (Original) The laser system of Claim 52 wherein said laser resonator cores are optically side coupled, edge coupled, fusion coupled, and/or prism coupled to said plural pump sources.

Serial No. 10/771,047 ..... Page 9

54. (Original) The laser system of Claim 52 further including a container accommodating said resonator cores, said container internally reflecting said input electromagnetic energy to facilitate coupling of said input electromagnetic energy with said laser resonator cores.

55. (Original) The laser system of Claim 54 wherein said container is a substantially flat disk or plate designed for total internal reflection of laser energy.

56. (Original) The laser system of Claim 54 wherein said container is spherical or cylindrical.

57. (Currently Amended) A method for generating an eye-safe laser beam comprising the steps of:

pumping plural fiber laser resonators with high power laser pump sources so that said resonators lase at eye-safe wavelengths and

spatial filtering to combine beams output from said plural fiber laser resonators into a single flat-top eye-safe laser beam via a cavity external to said fiber laser resonators.

**This Page is Inserted by IFW Indexing and Scanning  
Operations and is not part of the Official Record**

**BEST AVAILABLE IMAGES**

Defective images within this document are accurate representations of the original documents submitted by the applicant.

Defects in the images include but are not limited to the items checked:

- ☐ BLACK BORDERS
- ☐ IMAGE CUT OFF AT TOP, BOTTOM OR SIDES
- ☐ FADED TEXT OR DRAWING
- ☐ BLURRED OR ILLEGIBLE TEXT OR DRAWING
- ☐ SKEWED/SLANTED IMAGES
- ☐ COLOR OR BLACK AND WHITE PHOTOGRAPHS
- ☐ GRAY SCALE DOCUMENTS
- ☒ LINES OR MARKS ON ORIGINAL DOCUMENT
- ☐ REFERENCE(S) OR EXHIBIT(S) SUBMITTED ARE POOR QUALITY
- ☐ OTHER: \_\_\_\_\_

**IMAGES ARE BEST AVAILABLE COPY.**

**As rescanning these documents will not correct the image problems checked, please do not report these problems to the IFW Image Problem Mailbox.**